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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/619,943	07/15/2003	Ingrid B. Peterson	5589-06501	6799

61507 7590 06/15/2007
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EXAMINER

YUAN, KATHLEEN S

ART UNIT	PAPER NUMBER
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2624

MAIL DATE	DELIVERY MODE
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06/15/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/619,943

Applicant(s)

PETERSON ET AL.

Examiner

Kathleen S. Yuan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 June 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

The response received on 5/8/2007 has been placed in the file and was considered by the examiner. An action on the merit follows.

Response to Arguments

1. The arguments filed on 8 May 2007 have been fully considered. Response to these amendments is provided below.

Summary of Arguments and Examiner's Response:

2. The applicant has argued that the prior art cited does not recite, "aerial imaging" as known in the art as a direct image of what is projected.

3. Applicant's arguments, with respect to aerial imaging have been fully considered and are persuasive. The previous rejections have been withdrawn, and new rejections follow.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1, 3-6, 9, 10, 14, 15 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shykind et al in view of U.S. Patent No. 5932377 (Ferguson et al).

Regarding claim 1, Shykind et al discloses a method, comprising: acquiring images of a reticle (fig. 3) containing a design pattern by a detection circuit (fig. 2, item 204), wherein the images are acquired for different values of a member of a set of lithographic variables (fig. 8, item 300), the different values of a member of a set of lithographic variables being the different process conditions such as exposure time and focus setting; and determining a presence of an anomaly in the design pattern (fig. 8, item 808 and 810) by comparing at least one pair of the images corresponding to at least two of the different values (fig. 8, item 806).

Shykind et al does not disclose expressly that the images are aerial images. Shykind et al uses images of a printed die.

Ferguson et al discloses it is advantageous to take images of a mask by using aerial images (col. 7, lines 45-47) instead of using wafer exposures.

Shykind and Ferguson et al are combinable because they are from the same field of endeavor, i.e. imaging masks.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use an aerial image.

The suggestion/motivation for doing so would have been to provide a faster, more accurate method (col. 7, lines 51-52).

Therefore, it would have been obvious to combine the method of Shykind et al with the aerial imaging of Ferguson et al to obtain the invention as specified in claim 1.

6. Regarding claim 3, Shykind et al discloses the member comprises exposure (fig. 8, item 806).

7. Regarding claim 4, Shykind et al discloses a multi-die reticle (fig. 3).
8. Regarding claim 5, Shykind et al discloses that the anomaly comprises a design pattern defect since a defect is detected (fig. 8, item 810) that is part of the design pattern since the defect is detected from a patterned die made from a patterning mechanism (col. 2, lines 24-26).
9. Regarding claim 6, Shykind et al discloses an anomaly that is detected comprises a reticle enhancement technique defect, since the reticle defects that are detected are enhanced in the technique described in col., 3, line 65- col. 4, line 19).
10. Regarding claim 9, Shykind et al discloses inspecting the reticle for other types of anomalies using one of the images, and also using the other in comparison (fig. 8, item 806), wherein the other types of anomalies comprise reticle manufacturing errors, wherein the reticle manufacturing errors are those errors that are sorted as a mask defects which would cause manufacturing errors, and contaminants, or the naturally occurring random defects that are different in the images (fig. 8, item 808) since this was not a cause of the reticle errors and thus does not repeat in the images. Ferguson et al discloses it is advantageous to take images of a mask by using aerial images (col. 7, lines 45-47).
11. Regarding claim 10, Shykind et al discloses that the inspecting comprises a die-to-die comparison (fig. 8, item 804 and 806).
12. Regarding claim 14, Shykind et al discloses that if more than one anomaly is found in the design pattern, the method further comprises binning the more than one anomaly according to regions of the reticle proximate the more than one anomaly by

flagging the defect regions (fig. 8, item 810). This occurs if there is any amount of anomalies.

13. Regarding claim 15, Shykind et al discloses determining a process window for a lithography process to be carried out using the reticle, the process window being the area of the process for each of the processing conditions (fig. 3).

14. Regarding claim 17, Shykind et al discloses a method, comprising: acquiring images of a reticle (fig. 3) containing a design pattern by a detection circuit (fig. 2, item 204), wherein the images are acquired for different values of a member of a set of lithographic variables (fig. 8, item 300), the different values of a member of a set of lithographic variables being the different process conditions such as exposure time and focus setting; comparing at least one pair of the images corresponding to at least two of the different values (fig. 8, item 806); and determining an area on the reticle where a lithography process using the reticle is most susceptible to failure based on results of said comparing by determining the defect area, since a defect area is where the reticle is most susceptible to failure (fig. 8, item 808 and 810).

Shykind et al does not disclose expressly that the images are aerial images.
Shykind et al uses images of a printed die.

Ferguson et al discloses it is advantageous to take images of a mask by using aerial images (col. 7, lines 45-47) instead of using wafer exposures.

15. Claims 7, 16, 20-21 and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shykind et al in view of Ferguson, and further in view of "Critical Area Extraction for Soft Fault Estimation" (Allan et al).

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16. Regarding claim 20, Shykind et al discloses a method, comprising: inspecting a reticle containing a design pattern for defects (col. 1, lines 39-41); acquiring images of a reticle (fig. 3) containing a design pattern by a detection circuit (fig.2, item 204), wherein the images are acquired for different values of a member of a set of lithographic variables (fig. 8, item 300), the different values of a member of a set of lithographic variables being the different process conditions such as exposure time and focus setting; comparing at least one pair of the images corresponding to at least two of the different values (fig. 8, item 806).

Shykind et al does not disclose expressly that the images are aerial images and that non-transient defects are found and determining a presence of transient repeating defects on the reticle by subtracting the non-transient defects from the aerial images.

Ferguson et al discloses it is advantageous to take images of a mask by using aerial images (col. 7, lines 45-47) instead of using wafer exposures.

Shykind and Ferguson et al are combinable because they are from the same field of endeavor, i.e. imaging masks.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use an aerial image.

The suggestion/motivation for doing so would have been to provide a faster, more accurate method (col. 7, lines 51-52).

Shykind et al (as modified by Ferguson et al) does not disclose expressly that non-transient defects are found and determining a presence of transient repeating defects on the reticle by subtracting the non-transient defects from the aerial images.

Allan et al discloses finding hard and soft faults, which is equivalent to transient and non-transient defects, in an integrated circuit from a mask (abstract) and determining the soft faults by subtracting out the hard faults (pg. 3, paragraph 2).

Shykind et al (as modified by Ferguson et al) and Allan et al are combinable because they are from the same field of endeavor, i.e. defect detection in electronics.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to find and distinguish between soft/ hard defects.

The suggestion/motivation for doing so would have been to make a more accurate determination of the defect to show which areas are more critical (hard defects) and must be corrected.

Therefore, it would have been obvious to combine the method of Shykind et al with the hard/ soft defect detection of Allan et al and the aerial imaging of Ferguson et al to obtain the invention as specified in claim 20.

17. Regarding claim 21, Shykind discloses that the inspecting and said acquiring are performed substantially simultaneously since acquiring an image is part of an inspection process, thus, the processes are performed substantially at the same time (fig. 8).

18. Regarding claim 23, Shykind et al discloses inspecting is performed using non-aerial imaging reticle inspection system (fig. 2).

19. Regarding claim 24, Shykind et al discloses inspecting comprises a die-to-die comparison (fig. 8, item 806).

20. Claim 25 is rejected for the same reasons as claim 15. Thus, the arguments analogous to that presented above for claim 15 are equally applicable to claim 25.

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Claim 25 distinguishes from claim 15 only in that they have different dependencies and that claim 25's process window is based in transient defects. Since the dependencies both have been rejected and since the process window is based on finding all the defects including the transient defects, prior art applies.

21. Regarding claim 26, Allan discloses the non-transient defects comprise reticle manufacturing errors such as faults that cause shorts (g. 1, pp. 7), shorts being errors that are manufactured from a mask (abstract).

22. Regarding claim 7, Shykind et al discloses that the anomaly will print at the different values (fig 8, item 808). Allan et al discloses that the transient defect will print only under a portion 7. The method of claim 1, wherein the anomaly comprises a transient repeating defect that will print under only a portion of the different values, since it does not print over all of the surface, only a portion, as seen in fig 1.

23. Regarding claim 16, Allan et al discloses determining a critical status of the anomaly, whether a defect is a hard or soft defect (pg. 3, paragraph 2).

24. Claims 2, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shykind et al in view Ferguson et al, and further in view of U.S. Patent No 5046109 (Fujimori et al).

Regarding claim 2, Shykind et al (as modified by Ferguson et al) discloses all of the claimed elements as set forth above and incorporated herein by reference.

Shykind et al (as modified by Ferguson et al) does not disclose expressly one of the different values represents a reference member value.

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Fujimori et al discloses the use of reference data, DR, the reference member value that is used to compare to another input data (col. 3, lines 52-65), which is paralleled to the other value of Shykind et al by use of comparison between two pieces of data.

Shykind et al (as modified by Ferguson et al) and Fujimori et al are combinable because they are from the same field of endeavor, i.e. defect detection in electronics.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to compare to a reference value.

The suggestion/motivation for doing so would have been to provide a basis of what is the ideal, thus finding defects more quickly, and to provide a more accurate defect detection by providing multiple means of detecting defects.

Therefore, it would have been obvious to combine the method of Shykind et al (as modified by Ferguson et al) with the reference data of Fujimori et al to obtain the invention as specified in claim 2.

25. Claim 18 is rejected for the same reasons as claim 2. Thus, the arguments analogous to that presented above for claim 2 are equally applicable to claim 18. Claim 18 distinguishes from claim 2 only in that they have different dependencies, both of which have been previously rejected. Therefore, prior art applies.

26. Regarding claim 19, Shykind et al discloses that the area comprises anomalies that are common to the at least one pair of the aerial images not acquired at the reference member value, or aerial images at random different exposure times (fig. 8, item 808) since the mask defects are the defects that are common in multiple dice and

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random defects are the defects that are different. Fujimori et al discloses that the area comprises anomalies that are not common to the aerial image acquired at the reference member value, since Fujimori et al finds the differences between the reference and the input in order to find anomalies (col. 4, lines 30-33).

27. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shykind et al in view of Ferguson et al and Allan et al, as applied to claim 26 above, and further in view of Fujimori et al. Claim 22 is rejected for the same reasons as claim 2. Thus, the arguments analogous to that presented above for claim 2 are equally applicable to claim 22. Claim 22 distinguishes from claim 2 only in that they have different dependencies, both of which have been previously rejected by similar prior art. Therefore, prior art applies.

28. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shykind et al in view of Ferguson et al in view of U.S. Patent No 7133548 (Kenan et al).

Regarding claim 8, Shykind et al (as modified by Ferguson et al) discloses all of the claimed elements as set forth above and incorporated herein by reference.

Shykind et al (as modified by Ferguson et al) does not disclose expressly that the images are acquired with different detectors having the different values.

Kenan et al discloses having CCD cameras for an aerial imaging system (col. 7, lines 26-32. This is analogous to different detectors having the different values, since in a CCD camera there are many different CCD elements imaging the full object. Shykind

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et al's image of the full object contains the different values, as shown in fig. 3.

Therefore, by using the imaging system of Kenan et al of using multiple CCD elements and cameras for each pixel with the imaging of Shykind et al, different elements/detectors correspond to different values.

Shykind et al (as modified by Ferguson et al) and Kenan et al are combinable because they are from the same field of endeavor, i.e. defect detection in electronics.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use multiple detectors.

The suggestion/motivation for doing so would have been to provide an accurate way of imaging the object, thus providing a more accurate recognition later on.

Therefore, it would have been obvious to combine the method of Shykind et al (as modified by Ferguson et al) with the multiple detectors of Kenan et al to obtain the invention as specified in claim 8.

29. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shykind et al in view of Ferguson et al, as applied to claim 1 above, and further in view of U.S. Patent No. 5444480 (Sumita).

Regarding claim 11, Shykind et al discloses all of the claimed elements as set forth above and incorporated herein by reference. Ferguson et al discloses it is advantageous to take images of a mask by using aerial images (col. 7, lines 45-47) instead of using wafer exposures.

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Shykind et al does not disclose expressly that prior to said determining, preprocessing the at least one pair of the images to remove relatively high intensity values and relatively low intensity values from the at least one pair of the images.

Sumita discloses removing dark and bright areas of the image in a preprocessing step (col. 5, lines 8-15).

Shykind et al and Sumita are combinable because they are from the same field of endeavor, i.e. image processing in inspection systems.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to remove the high and low intensities.

The suggestion/motivation for doing so would have been to provide a contrast-enhanced image by removing areas that are too dark and too bright.

Therefore, it would have been obvious to combine the method of Shykind et al (as modified by Ferguson et al) with the removal of dark and bright regions, as disclosed by Sumita to obtain the invention as specified in claim 11.

30. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shykind et al in view of Ferguson et al, as applied to claim 1 above, and further in view of U.S. Patent Application Publication No. 20020181756 (Shibuya et al).

Regarding claim 12, Shykind et al (as modified by Ferguson et al) discloses all of the claimed elements as set forth above and incorporated herein by reference. Shykind et al further discloses identifying regions of the reticle based on a location of the anomaly by flagging the defects, thus marking where the defects are (fig. 8, item 810).

Shykind et al (as modified by Ferguson et al) does not disclose expressly that the flagged regions are reviewed.

Shibuya et al discloses that flagged regions are reviewed (pg. 7, pp 86).

Shykind et al (as modified by Ferguson et al) and Shibuya et al are combinable because they are from the same field of endeavor, i.e. defect detection.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to review flagged defect regions.

The suggestion/motivation for doing so would have been to provide a more accurate result by verifying that the defect exists and finding the type of defect.

Therefore, it would have been obvious to combine the method of Shykind et al (as modified by Ferguson et al) with the review of Shibuya et al to obtain the invention as specified in claim 12.

31. Regarding claim 13, review comprises image review at varying levels of optical conditions, or varying levels of optical locations since defects are in different locations (pg. 7, pp 86). Ferguson et al discloses it is advantageous to take images of a mask by using aerial images (col. 7, lines 45-47).

Conclusion

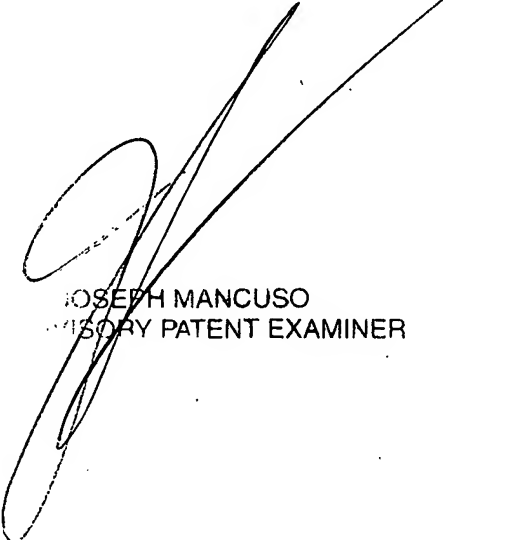
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kathleen S. Yuan whose telephone number is (571)272-2902. The examiner can normally be reached on Monday to Thursdays, 9 AM to 5 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Mancuso can be reached on (571)272-7695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KY
6/5/2007



JOSEPH MANCUSO
PATENT EXAMINER